

Peripheral Inflammatory Parameters in Patients with Antisocial Personality Disorder

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ABSTRACT

Introduction: The aim of the study was to examine the peripheral inflammatory parameters in patients with Antisocial Personality Disorder (APD) including white blood cell levels, red cell distribution width (RDW), mean platelet volume (MPV), neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), monocyte-to-lymphocyte ratio (MLR), basophil-to-lymphocyte ratio (BLR) by comparing with those of healthy controls.

Methods: 48 patients diagnosed with APD and a matched healthy control group of 52 individuals were included in our study. Venous blood samples were taken from the participants in the fasting state and at approximately the same time of the day. Socio-demographic data sheet, Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI), Barratt Impulsiveness Scale (BIS-11), Buss-Durkee Hostility Inventory (BDHI) were applied to all of the participants.

Results: RDW and basophil cell levels were found significantly higher in the patients than the controls ($p=0.005$, $p=0.038$ respectively). BLR was found significantly higher in the participants with alcohol use than

those without alcohol use ($p=0.016$). No significant difference in other laboratory parameters was found between the patient group and the control group. Scores of BDI, BAI, BIS-11, motor impulsivity subscale and physical aggression, anger, hostility and verbal aggression subscales of BDHI, and the total score of BDHI were significantly higher in patients than controls ($p<0.001$, $p<0.001$, $p<0.001$, $p<0.001$, $p<0.001$, $p=0.003$, $p=0.001$, $p<0.001$ respectively). A positive correlation was determined between the scale scores and the RDW, basophil, monocyte, lymphocyte levels among the laboratory parameters, and a negative correlation was determined between the MPV levels and the depression and impulsivity levels.

Conclusion: The results of our study suggested that inflammation might play a role in the etiopathogenesis of APD. Furthermore, a significant relationship was found between the severity of symptoms and some inflammatory parameter levels such as RDW and basophil in APD patients.

Keywords: Antisocial Personality Disorder, inflammatory markers, basophil, RDW

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INTRODUCTION

Antisocial Personality Disorder is a personality disorder pattern characterized by unlawful and unethical behaviors, self-centeredness, indifference to others, hardness of heart, irresponsibility, impulsivity, aggression, fraudulence, being manipulative and/or taking risks (1). Aggressive behavior that can be seen in many psychiatric disorders is a general behavior pattern in patients with APD (1, 2). Recent studies found that patients with serious mental illness conditions such as schizophrenia, bipolar disorder (BD), substance abuse, and personality disorders have higher rates of violent behavior (3). It has been shown that violent behavior increases three to four times in anxiety disorder, dysthymia, major depressive disorder (MDD), and eight times in BD, drug or alcohol use disorder (4). Due to the complexity of APD, many genetic, environmental, biological, psychodynamic, cognitive, and psychosocial factors are emphasized in the etiology of the disease (5). Although it is suggested that the disease might result from the interaction of these factors, the etiopathogenesis of APD is not fully understood.

Inflammatory parameters are one of the most emphasized fields in recent studies on the etiology of psychiatric diseases (6–9). It has been reported that stressful life experiences are associated with elevated pro-

inflammatory cytokines in childhood, which also plays an important role in mental disorders in adulthood (10). Elevated cytokine levels in the central nervous system have been suggested to strongly influence

Highlights

- Peripheral inflammatory parameters were investigated in patients with Antisocial Personality Disorder (APD).
- The study included 48 patients with APD and a healthy control group of 52 people.
- Red cell distribution width (RDW) and basophil levels were found to be significantly higher in patients.
- Basophil-to-lymphocyte ratio was found to be significantly higher in alcohol users compared to non-alcoholics.
- Finally, it has been suggested that inflammation is effective in the etiopathogenesis of APD.

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dopaminergic, noradrenergic, and serotonergic neurotransmission, as well as reported to play a role in mental disorders (11). The effect of inflammatory processes has been observed in many mental disorders including impulsivity and aggression, such as schizophrenia, BD, MDD, anxiety disorder, attention deficit and hyperactivity disorder (ADHD), autism spectrum disorders (ASD), and heroin addiction (6, 12, 13). However, no study was conducted to investigate the correlation between aggression, impulsivity, and inflammation parameters in APD patients. Therefore, the aim of our study was to examine the inflammatory parameters in patients with APD by comparing them with those of healthy controls.

METHOD

For this study, approval was obtained from the Clinical Research Ethics Committee of Firat University on 11.04.2019. Forty-eight patients diagnosed with APD according to DSM-5 diagnostic criteria who have undergone outpatient or inpatient treatment in the Elazığ Mental Health and Diseases Hospital and the psychiatric department of Elazığ Fethi Sekin City Hospital and who met the study criteria, and 52 age- and gender-matched controls did not have any psychiatric, neurological and metabolic disease in their past and present history were included in the study. The detailed history of all the participants was taken. Since APD is often accompanied by anxiety and depression symptoms, only the patients with mild anxiety and depression symptoms were included in the study. Those who were diagnosed with mental disorder other than APD, those who were with another personality disorder, those with a physical illness which may affect the psychiatric symptoms, those with a blood disease, those who were illiterate, and those who were not willing to participate in the study were excluded from the study.

Socio-demographic and clinical data sheet, Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI), Barratt Impulsiveness Scale (BIS-11), Buss-Durkee Hostility Inventory (BDHI) were administered to both the patient group and the healthy control group.

Data Collection Instruments

Socio-demographic and Clinical Data Form: The socio-demographic and clinical data form which we have prepared based on our clinical experience and the information obtained from the reviewed resources taking into account the objectives of the study was used to evaluate the cases. This form was a semi-structured form containing socio-demographic information such as age, gender, marital status, educational status, profession, economic situation as well as clinical data such as smoking, alcohol use, drug use, and medications.

Beck Depression Inventory (BDI): It was developed by Beck in 1961 to measure the risk of depression, and the level and severity of depressive symptoms in adults (14). It is a Likert-type self-report scale with 21 items, each rated on a scale of 0–3, and a cut-off score of 17. The total score ranged from 0 to 63. A score between 0–9 indicates no depressive symptoms, 10–16 mild depressive symptoms, 17–24 moderate depressive symptoms and, 25 and higher severe depressive symptoms. The Turkish validity and reliability studies were conducted in 1989 by Hisli (15).

Beck Anxiety Inventory (BAI): It was developed by Beck et al. (16). It is a 21-item self-report scale used to determine the frequency and severity of anxiety symptoms experienced by individuals. Each item is ranked between 0 and 3, higher scores indicate higher anxiety level. Validity and reliability tests of the Turkish version of the scale were conducted by Ulusoy (17).

Barratt Impulsiveness Scale (BIS-11): Impulsivity is one of the important clinical characteristics of several mental disorders. The BIS-11

was developed by Patton et al. (18), and was translated into Turkish by Güleç et al. (19).

Buss-Durkee Hostility Inventory (BDHI): It was developed to measure the aggressive potential of individuals. It is a Likert-type self-report scale consisting of 34 items, each rated on a scale of 1–5. It has physical aggression, verbal aggression, anger, hostility, indirect aggression sub-scales. Furthermore, the overall aggression is calculated based on the total score, and the higher scores indicate a higher aggressive tendency (20). Validity and reliability tests of the Turkish version of the scale were conducted by Can (21).

Hematological Analysis

3 ml venous blood samples were taken from the individuals in the patient and control groups after 8–12 hours of fasting. The samples were taken from all the participants at approximately the same time of day. On the same day, the samples were centrifuged within 30 minutes using “CELL-DYN 3700 SL analyzer (Abbott Diagnostics, Chicago, USA)” in the biochemistry laboratory of the Elazığ Fethi Sekin City Hospital.

Statistical Analysis

A statistical software package, SPSS 22 for Windows (Statistical Package for Social Sciences for Windows 22), was used to evaluate the data obtained from the participants. Descriptive analyses, including frequency, percentage distribution, mean \pm standard deviation calculations, were made to give information about the general characteristics of the participants. The continuous variable data were given as mean \pm standard deviation, and the categorical variable data were given as n (%). The qualitative variables in the study were demographical data such as gender, age, educational status, socioeconomic situation as well as smoking, alcohol use, drug use, and accompanying medical conditions. Cross-tabs and chi-square tests were used to evaluate whether there is an association between the qualitative variables. The quantitative variables were the scores from the scales administered to the participants as well as the blood parameters such as neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), and monocyte-to-lymphocyte ratio (MLR). Independent samples t-test and Pearson Correlation analysis were used to evaluate whether there is an association between the quantitative variables. The p values calculated below 0.05 were regarded as statistically significant.

RESULTS

100 participants were included in the study. Forty eight individuals diagnosed with APD based on the DSM-5 criteria, and 52 healthy controls were included. The mean age of the participants in the study was 29.31 ± 6.1 (years) for the patient group and 29.52 ± 6.4 (year) for the control group ($p=0.871$). All the participants were male. There was no significant difference in accompanying medical condition and non-psychiatric medication use rates between the groups ($p>0.05$). The majority of the patients were primary school graduates ($n=22$, 45.8%) in the patient group, while the majority of the controls were high-school graduates ($n=21$, 40.3%) and university graduates ($n=23$, 44.2%) ($p<0.001$). The majority of the patients had tattoos and scars ($n=43$, 89.5%). The socio-demographic data of the participants were given in Table 1.

The scores of the BAI and BDI scales used for the evaluation of depression and anxiety were found higher in the patients than the healthy controls ($p<0.001$, $p<0.001$, respectively). The scores of the physical aggression, anger, hostility, verbal aggression sub-scales of the BDHI and the overall scale score were higher in the patient group than the control group ($p<0.001$, $p<0.001$, $p=0.003$, $p=0.001$, $p<0.001$, respectively). No significant difference was found in the BDHI indirect aggression sub-scale scores

Table 1. Sociodemographic characteristics of the participants

	Patient group (n=48) n (%)	Control group (n=52) n (%)	P
Age (mean ± SD)	29.3±6.1	29.5±6.5	0.871
Gender (Male/Female)	48/0	52/0	
Marital status			
Single	32 (66.6%)	18 (34.6%)	<0.001
Married	10 (20.8%)	33 (63.4%)	
Divorced	6 (12.5%)	1 (1.9%)	
Occupation			
Employee	13 (27.1%)	51 (98.1%)	<0.001
Unemployed	35 (72.9%)	1 (1.9%)	
Alcohol use	18/17/13	3/47/2	<0.001
(yes/no/left)	(37.5/35.4/27.1%)	(5.8/90.3/3.8%)	
Substance use	12/19/17	0/52/0	<0.001
(yes/no/left)	(25/39.5/35.4%)	(0/100/0%)	
Smoking	44/3/1	33/16/3	0.003
(yes/no/left)	(91.6/6.2/2.1%)	(63.4/30.7/5.8%)	
Medical illness	02/46	0/52	0.137
(yes/no)	(4.1/95.8%)	(0/100%)	

mean ± SD, mean ± standard deviation. Chi square test was used in calculations. P<0.05 was considered statistically significant.

Table 2. Comparison of patient and control group scale scores

	Patient group (n=48) (mean ± SD)	Control group (n=52) (mean ± SD)	P
BAI	24.04±15.5	7.09±6.9	<0.001
BDI	27.1±16.6	5.8±6.5	<0.001
BIS-11			
Attention-related impulsivity	31.0±4.05	31.1±5.19	0.911
Motor impulsivity	15.2±4.7	11.4±2.3	<0.001
Premeditated impulsivity	19.5±2.8	18.6±3.5	0.197
BDHI			
Physical aggression	5.0±1.96	2.74±1.52	<0.001
Anger	3.75±1.42	3.2±1.30	0.092
Hostility	5.2±1.89	3.42±2.37	<0.001
Indirect aggression	3.58±1.28	2.6±1.59	0.03
Verbal aggression	10.06±2.67	7.8±3.2	0.001
Total aggression	24.1±6.3	17.3±6.27	<0.001

BAI, Beck anxiety inventory; BDI, Beck' depression inventory; BIS-11, Barratt impulsiveness scale; BDHI, Buss-Durkee hostility inventory. Independent samples t test was used in calculations. P<0.05 was considered statistically significant.

(p=0.092). The BIS-11 motor impulsivity sub-scale score was significantly higher in the patient group (p<0.001). No significant difference was found in the BIS-11's other sub-scale scores (p>0.05) (Table 2).

When the laboratory parameters of the participants were examined, no significant difference was found in white blood cell (WBC), red blood cell

Table 3. Analysis of laboratory parameters of the participants

	Patient group (n=48) (mean ± SD)	Control group (n=52) (mean ± SD)	P
WBC (10 ³ /uL)	8.52±2.12	7.86±1.61	0.083
RBC (10 ⁶ /uL)	5.30±0.39	5.38±0.33	0.258
Hemoglobin (g/dL)	15.68±1.43	15.91±0.72	0.303
Hematocrit (%)	45.55±3.18	45.96±2.16	0.444
MCV (fL)	86.16±6.37	85.8±3.49	0.735
MPV (fL)	9.23±1.39	9.08±1.21	0.555
Platelets (10 ³ /uL)	270.18±74.96	244.96±59.3	0.064
Lymphocytes (10 ³ /uL)	2.56±0.77	2.31±0.6	0.075
Monocytes (10 ³ /uL)	0.66±0.22	0.63±0.24	0.581
Neutrophils (10 ⁶ /uL)	5.11±1.90	4.64±1.34	0.154
Eosinophils (10 ³ /uL)	0.19±0.15	0.18±0.13	0.742
Basophils (10 ³ /uL)	0.45±0.22	0.36±0.20	0.038*
RDW (%)	41.07±2.84	39.6±2.16	0.005*
PLR	111.54±35.1	110.29±32.2	0.854
NLR	2.21±1.28	2.09±0.71	0.559
MLR	0.27±0.096	0.28±0.11	0.556

WBC, white blood (leucocyte) cell; RBC, red blood (erythrocyte) cell; MCV, mean corpuscular volume; MPV, mean platelet volume; RDW, red cell distribution width; PLR, platelet-to-lymphocyte ratio; NLR, neutrophil-to-lymphocyte ratio; MLR, monocyte-to-lymphocyte ratio; mean ± SD, mean ± standard deviation. Independent samples t-test was used.

*When p<0.05, the result was considered to be statistically significant.

(RBC), mean corpuscular volume (MCV), mean platelet volume (MPV), hemoglobin, hematocrit, lymphocyte, neutrophil, eosinophil levels between the patient group and the control group (p>0.05), while the basophil and red cell distribution width (RDW) levels were significantly higher in the patient group (p=0.03, p=0.005, respectively). There was no significant difference in the NLR, PLR, MLR levels (p=0.559, p=0.854, p=0.556, respectively). The basophil-to-lymphocyte ratio levels were significantly higher in the participants with alcohol use than those without alcohol use (p=0.016) (Table 3).

The correlation analysis showed a positive correlation between the scale scores and the RDW, basophil, monocyte, lymphocyte levels among the laboratory parameters, and a negative correlation between the MPV levels and the depression and impulsivity scale scores (Table 4).

The correlation analysis showed that there was a positive correlation between the BAI, BDI scale scores, the BIS-11 motor impulsivity sub-scale scores, the BDHI physical aggression, indirect aggression, and anger sub-scale scores, and the overall sum score in the patient groups (Table 5).

DISCUSSION

In our study, representing the first study to investigate the role of inflammation in APD pathophysiology, WBC levels, RDW, MPV, NLR, PLR, MLR, BLR values and anxiety, depression, aggression, and impulsivity levels were compared between the APD patients and the healthy controls. In our study, the RDW and basophil levels were found significantly higher in the APD group. The BLR values were found significantly higher in the participants with alcohol use than those without alcohol use. No significant difference was found in other laboratory parameters and NLR, PLR, and MLR values between the patient group and the control group. The anxiety, depression, aggression, and motor impulsivity levels were found significantly higher in the patient group than the control group.

Table 4. Pearson correlation analysis of the laboratory parameters and scale scores of the patients

		MPV	RDW	Basophils	Platelets	Lymphocytes	Monocytes	Neutrophils
BAI	r	-0.151	0.222	0.322*	0.140	0.259	0.326*	-0.045
	p	0.307	0.129	0.026	0.343	0.076	0.024	0.760
BDI	r	-0.309*	0.270	0.222	0.056	0.228	0.130	-0.160
	p	0.033	0.064	0.130	0.704	0.120	0.379	0.277
BIS-11								
Attention-related impulsivity	r	-0.032	-0.143	-0.056	0.153	0.317*	0.153	-0.064
	p	0.830	0.333	0.707	0.300	0.028	0.299	0.665
Motor impulsivity	r	-0.377**	0.329*	0.009	0.238	0.245	-0.001	0.038
	p	0.008	0.023	0.954	0.103	0.093	0.995	0.798
Premeditated impulsivity	r	-0.305*	0.153	0.015	-0.017	0.035	0.182	0.082
	p	0.035	0.299	0.920	0.909	0.811	0.216	0.578
BDHI								
Physical aggression	r	-0.284	-0.076	0.029	0.175	0.119	-0.087	0.007
	p	0.050	0.605	0.846	0.235	0.419	0.555	0.960
Indirect aggression	r	-0.064	0.317*	0.253	0.144	0.243	-0.067	0.096
	p	0.664	0.028	0.082	0.329	0.096	0.651	0.518
Anger	r	-0.277	0.242	0.059	0.143	0.321*	-0.045	-0.011
	p	0.056	0.098	0.692	0.331	0.026	0.760	0.940
Hostility	r	-0.077	-0.007	-0.056	-0.043	-0.011	0.256	0.242
	p	0.603	0.961	0.708	0.770	0.943	0.079	0.097
Verbal aggression	r	0.042	0.149	0.033	0.017	-0.006	0.202	0.205
	p	0.774	0.313	0.823	0.910	0.968	0.168	0.162
Total aggression	r	-0.170	0.190	0.101	0.122	0.173	0.006	0.089
	p	0.247	0.197	0.495	0.411	0.239	0.967	0.546

BAI, Beck anxiety inventory; BDI, Beck's depression inventory; BIS-11, Barratt impulsiveness scale; BDHI, Buss-Durkee hostility inventory.

Pearson correlation coefficient was used in the calculations.

The values given in the table are 'r' and 'p' values.

When *p<0.05, **p<0.001, the result was considered to be statistically significant.

Table 5. Pearson correlation analysis between the scores of the Buss-Durke Hostility Inventory and the other scales of the patients

		Physical aggression	Indirect aggression	Anger	Hostility	Verbal aggression	Total aggression
BAI	r	0.468**	0.438**	0.484**	0.198	0.254	0.482**
	p	0.001	0.002	0.000	0.176	0.082	0.001
BDI	r	0.412**	0.438**	0.512**	0.190	0.226	0.463**
	p	0.004	0.002	<0.001	0.195	0.122	0.122
BIS-11							
Attention-related impulsivity	r	0.027	-0.096	-0.006	-0.053	-0.186	-0.103
	p	0.857	0.517	0.970	0.720	0.205	0.488
Motor impulsivity	r	0.333*	0.412**	0.448**	0.262	0.289*	0.430**
	p	0.021	0.004	0.001	0.072	0.046	0.002
Premeditated impulsivity	r	0.031	-0.198	0.018	0.221	-0.052	-0.053
	p	0.837	0.176	0.902	0.130	0.130	0.723

BAI, Beck anxiety inventory; BDI, Beck's depression inventory; BIS-11, Barratt inventory scale

Pearson correlation coefficient was used in the calculations.

The values given in the table are 'r' and 'p' values.

When *p<0.05, **p<0.001, the result was considered to be statistically significant.

We found positive correlations between the RDW, basophil, monocyte, lymphocyte levels and the anxiety, depression, impulsivity, and aggression levels. There were negative correlations between the MPV values and the depression, and impulsivity levels.

In the literature, there is a limited number of studies to investigate the RDW values in mental disorders. It was demonstrated that RDW is used for differential diagnosis of anemia as well as serves as a mortality marker for the general population and those with various diseases such as acute or chronic heart failure, pulmonary embolism, acute myocardial infarction, peripheral artery disease, and acute kidney failure (22). Many publications reported that inflammation and oxidative stress affect RDW (23). It was also demonstrated that RDW reflects an increase in the levels of circulating hepcidin, IL-6, TNF-alpha, and other cytokines (24). In a study investigating the RDW levels in panic disorder as an anxiety disorder, no significant difference was found between the control group and the patient group (25), while another study concluded that they were significantly higher in the patient group (26). In a study investigating the RDW levels in depression patients, no significant difference was found between the control group and the patient group (27), while another study concluded that they were significantly higher in the patient group. The authors suggested that an elevated RDW level is the result of the early release of reticulocytes into the circulation during inflammatory and infectious pathologies (28). This study supports the RDW results of our study.

In our study, the basophil, a type of WBC counts, were found higher in the patient group than the control group. There is a limited number of studies investigating the basophil cell levels in mental disorders. In a study conducted on the patients with developmental stuttering, it was reported that the basophil and platelet counts were higher, while the MPV value was lower in the patient group than the control group (29). Impulsivity and aggression are common findings in ASD, and an increase in basophils and eosinophils was observed in a study conducted in ASD (13). The ability of basophils to recognize and to react to antigen suggests that they may be involved in the development of memory immune responses. Allergic conditions have been reported to occur more frequently in developmental disorders. Strom and Silverberg (30) reported that paediatric eczema may be associated with an increased risk of speech disorder. For these reasons, basophil suggests a possible association between developmental psychiatric disorders and previous infections (29). In another study investigating the basophil counts in mental disorders, it was reported that the complete blood count parameters such as basophil have been usually interpreted as part of acute inflammatory events, but basophils had a memory response. Hence the values identified in the disease might probably reflect a chronic event (31). The basophil levels were found higher in the patient group than the control group in our study, supporting that inflammation may influence APD as a chronic process.

In our study, no significant difference was found in the NLR, PLR, MLR, and MPV values between the patient and control groups. There are numerous studies investigating the NLR, PLR, MLR and MPV values in mental disorders. In children with ADHD, another disease in which impulsivity and aggression are very common, some studies found no relationship between inflammation parameters and ADHD (32), while some studies found an increase in ADHD (33).

In a study on the NLR, PLR, MPV values in panic disorder as an anxiety disorder, it was reported that there was no statistically significant difference (25), while another study reported that the WBC and, MPV levels were higher in the patient group than the control group (26). It was seen that the results obtained for MDD, a mental disorder for which the inflammation parameters have been mostly examined, were inconsistent. However, the majority of the studies suggested that the inflammation parameters were elevated (28, 34).

The majority of the studies confirm that inflammation plays a role in schizophrenia and bipolar patients. In a study comparing patients with schizophrenia, BD and MDD, it was reported that the haematological inflammatory parameters were elevated in these three patient groups, but the inflammatory parameters were higher in schizophrenia than BD and MDD (7). In a study examining the relationship between violent behavior, crime, and inflammation parameters; it has been determined that inflammatory parameters are higher in patients with BD who are involved in crime than the group not involved in crime and the healthy control group (35).

In a study on heroin addicts, it was reported that the NLR and PLR values were significantly higher in the patient group than the control group, which showed a positive correlation with the duration of disease (36). In a study on alcohol addicts, it was reported that there was a negative correlation between the BLR and the duration of alcohol use (37). However, Örüml et al. (30) reported no association between basophil and opioid use. In our study, the BLR values were found significantly higher in the participants with alcohol use than those without alcohol use.

As expected, the anxiety, depression, motor impulsivity, and aggression levels were found significantly higher in the patients with APD than the controls. The literature reviews also showed that the depression and anxiety levels were elevated in APD patients (38). The impulsivity and aggression levels were found elevated in the APD patients due to the DSM-5 criteria (1).

The negative correlation between the MPV values among laboratory parameters and the depression and impulsivity levels, and the positive correlation between the lymphocyte, monocyte, basophil, and RDW values and the anxiety, depression, impulsivity, and aggression levels suggested that inflammation might influence psychiatric symptoms.

Limitations of the Study

The study sample consisted of male participants only, and the number of participants is relatively low, making it difficult to generalize and interpret the results. Also, smoking, alcohol, substance abuse, lifestyle, and diet of the individuals were confounding factors that might affect the blood parameters. Alcohol and substance use is very common in people with APD. In our study, 37.5% of patients with APD have alcohol use and 25% have substance use. The results we obtained in our study may also be a result of alcohol and substance use. For this reason, our study is a preliminary study to conduct comprehensive studies comparing individuals with alcohol and substance use but not diagnosed with APD and individuals with alcohol and substance use but diagnosed with APD. In order to verify these results and to make the underlying mechanism clear, further studies should be performed on larger sample groups including both genders, taking into account these confounding factors.

CONCLUSION

Our study is the first study in the literature, where the effect of peripheral inflammation parameters on the etiopathogenesis of APD has been examined. The basophil, a type of white blood cell, and RDW values were found higher in the APD patients. The depression, anxiety, motor impulsivity, and aggression levels were found significantly higher in the patient group. We found a positive correlation between the RDW, basophil, monocyte, lymphocyte levels and the anxiety, depression, impulsivity, and aggression levels and a negative correlation between the MPV values and the depression and impulsivity levels. In this regard, inflammation has been suggested to have an influence on the etiopathogenesis of APD. However, further studies are needed to clarify the association between APD and inflammatory markers.

Ethics Committee Approval: The study was approved by the Firat University Clinical Research Ethics Committee with the decision number 03 dated 11.04.2019.

Informed Consent: Written informed consent was obtained from all participants.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept– SK; Design– ŞK; Supervision– GT; Resources– GT; Materials– ŞK, GT; Data Collection and/or Processing– ŞK, GT; Analysis and/or Interpretation– SK, GT; Literature Search– GT; Writing Manuscript– GT; Critical Review– SK, MA.

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